NON-PUBLIC?: N
ACCESSION #: 8802080179

LICENSEE EVENT REPORT (LER)

FACILITY NAME: NORTH ANNA POWER STATION, UNIT 1 PAGE: 1 of 5

DOCKET NUMBER: 05000338

TITLE: MANUAL REACTOR TRIP IN ANTICIPATION OF LOSS OF THE MAIN CONDENSER
EVENT DATE: 01/08/88 LER #: 88-002-00 REPORT DATE: 02/03/88

OPERATING MODE: 1 POWER LEVEL: 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
NAME: E. Wayne Harrell, Station Manager TELEPHONE #: 703-894-5151

SUPPLEMENTAL REPORT EXPECTED: No

ABSTRACT: At 0438 hours on January 8, 1988, Unit 1 was manually tripped from approximately 100 percent power (Mode 1). The manual trip was initiated in anticipation of loss of the main condenser after the three running circulating water (CW) pumps tripped simultaneously and condenser vacuum was observed to be decreasing rapidly.

Following the reactor trip, an electrical troubleshooting procedure was developed and performed to duplicate the events immediately prior to the simultaneous tripping of the three running CW pumps. No equipment problems (relays, timers, etc.) were identified which could account for the simultaneous tripping of the CW pumps. Additional testing was performed on the CW pump/condenser waterbox trip interlock protection circuitry in an attempt to determine the potential cause for the loss of all the CW pumps. As a result, the exact cause of the simultaneous tripping of the CW pumps could not be determined.

This event posed no significant safety implications because all safety related equipment functioned as designed, with the exception of the steam driven auxiliary feedwater pump which successfully started and operated for about 40 minutes before tripping unexpectedly. Also, key reactor parameters stabilized, as expected, following the reactor trip. The health and safety of the general public were not affected.

This event is reportable pursuant to 10CFR50.73(a)(2)(iv).

(End of Abstract)

1.0 Description of Event

At 0438 on January 8, 1988, Unit 1 was manually tripped from approximately 100 percent power (Mode 1). The manual trip was initiated in anticipation of a loss of the main condenser vacuum (EIIS System Identifier SG) when the three running circulating water (CW) pumps (EIIS System Identifier KE, Component Identifier P) tripped simultaneously and condenser vacuum was observed to be decreasing rapidly. This event is reportable pursuant to 10CFR50.73(a)(2)(iv). A four hour report was made in accordance with 10CFR50.72(b)(2)(ii).

The purpose of the CW system protection circuitry is to protect the CW intake tunnel from pressure transients. This protection circuitry consists of various interlocks. The two protection circuit interlocks applicable to this event are 1) when all the CW pumps are tripped the condenser waterbox vacuum breakers open automatically, and 2) when one of the two (1/2) condenser water box vacuum breakers opens on at least two of the four (2/4) water boxes all the running CW pumps are tripped. Although extensive testing and troubleshooting has been performed, it is not definite which protection circuit actuated first.

Prior to the reactor trip, no major equipment problems existed except for periodic blockage by fish of the CW pump screens located at the CW intake structure on Lake Anna. The fish were immobilized due to the low lake water temperature caused by the recent severe, cold weather. To address this problem, the CW pumps were frequently stopped and started to permit cleaning of screens and to replace the traveling screen sheer pins. The simultaneous tripping of the CW pumps was not directly due to the fish intrusion, which had abated approximately thirty minutes earlier.

Following the reactor trip, primary pressure and temperature decreased to approximately 1900 psig and 547 degrees F, respectively, then stabilized at the normal no load values of 2235 psig and 547 degrees F. The loss of the CW pumps resulted in a rapid increase in the condenser pressure and caused seven low pressure turbine-disks to blow out. Also, with the condenser no longer available to remove secondary side heat via the condenser steam dumps, steam was released through the steam generator power operated relief valves to the atmosphere.

Based on a review of plant parameters, it has been determined that at least one Main Steam (MS) safety valve opened. The MS safety valve opened, as designed, to relieve the increase in secondary side pressure which occurred when the main condenser was lost. Plant equipment responded as expected with the following exceptions:

* The steam driven auxiliary feedwater (AFW) pump (EIIS System Identifier BA, Component Identifier P) successfully started and operated for about 40 minutes but tripped unexpectedly. As a result of this condition, Abnormal Procedure 22, "Steam Generator Auxiliary Feedwater System Alternate Lineups," was entered. The apparent cause of the pump trip was a blown plug in the stroke limiter/regulator valve. This blown plug possibly struck the trip valve linkage or allowed steam to impinge on the trip valve linkage and caused the valve to shut. A modification to remove the stroke limiter/regulator valve was performed at the recommendation of the turbine vendor. Subsequently, the steam driven AFW pump was tested with satisfactory results. (This modification will also be performed on the Unit 2 steam driven AFW pump).

* The Intermediate Range Nuclear Instrumentation (NI) (EIIS System Identifier, IG, Component Identifier DET) was undercompensated, and the Source Range Nuclear Instrumentation did not automatically energize. The Intermediate Range NI's compensating voltage was adjusted during Mode 3 using a procedure deviation. This voltage change did not give the desired results and was subsequently returned to its initial setting. As a long term solution, the Nuclear Fuel Operations group is developing a basis for adjusting the compensation voltage during power operations. The Source Range Nuclear Instrumentation was manually energized approximately 33 minutes after the trip, in accordance with an approved procedure.

2.0 Safety Consequences and Implications

This event posed no significant safety implications because all safety related equipment functioned as designed, with the exception of the steam driven auxiliary feedwater pump which successfully started and operated for about 40 minutes before tripping unexpectedly. The tripping of the steam driven AFW pump did not result in any significant decrease in the "A" S/G level. An adequate heat sink remained available throughout this event and key reactor parameters stabilized, as expected, following the reactor trip. The health and safety of the general public were not

affected.

3.0 Cause of the Event

The manual reactor trip was initiated in anticipation of loss of the main condenser vacuum, after all three CW pumps simultaneously tripped. The exact cause of the simultaneous tripping of the CW pumps has not been determined.

4.0 Immediate Corrective Action

As an immediate corrective action, Abnormal Procedure 13, "Loss of One or More Circulating Water Pumps," was entered and the reactor was manually tripped.

5.0 Additional Corrective Action

As an additional corrective action, the following post-trip testing was performed in an attempt to determine the root cause of the simultaneous tripping of the CW pumps:

* An electrical troubleshooting procedure was developed and performed to duplicate the events immediately prior to the simultaneous tripping of the three running CW pumps. No equipment problems (relays, timers, etc.) were identified which could account for the tripping of the CW pumps.

* The limit switches on the waterbox vacuum trip breaker valves were inspected. As a result of this inspection, one limit switch was discovered to have corrosive buildup. Since no spare parts were available at this time, the limit switch was removed from operation, under the control of a jumper which disconnected the leads.

Also, a Significant Event Review was performed by Virginia Power Corporate management with the licensed operators involved in this event and station management.

6.0 Actions Taken to Prevent Recurrence

Surveillance and Test Engineering has been requested to evaluate if surveillance on th
Unit 1 and Unit 2 CW systems protection circuitry
could identify actual and potential equipment failures. Any significant findings which result from this study will be implemented as necessary.

The following additional testing was performed, while the Unit was in Mode 5, in an attempt to determine the potential cause for the simultaneous tripping of the CW pumps:

* The logic for 1/2 condenser waterbox vacuum breaker valves opening on 2/4 waterboxes was verified to energize the appropriate relays necessary to trip the CW pumps.

* A preliminary test was performed to check the functioning of the CW pumps trips to open the condenser waterbox vacuum breaker valves. (The ability of each solenoid operated valve to open the associated valve was tested). The train "B" solenoid operated valves operated correctly to open the condenser waterbox vacuum breakers. One of the train "A" solenoid operated valves did not open the associated trip valve but has subsequently been replaced.

* The "G" bus undervoltage path and the eleven different CW pump trip paths were tested to verify that the condenser waterbox vacuum breakers opened. All the condenser waterbox vacuum breaker valves opened upon demand and were verified to reclose after approximately 10 minutes as designed.

* A test was performed to verify that when 1/2 condenser waterbox vacuum breaker valves opened on at least 2/4 waterboxes, any running CW pumps tripped. All CW pump breakers were verified to receive a trip signal when 1/2 condenser waterbox vacuum breaker valves opened on at least 2/4 waterboxes.

7.0 Similar Events

On August 4, 1987, a similar event occurred on Unit 1 and resulted in the simultaneous tripping of all three running CW pumps. This event did not result in a reactor trip because the Unit was in Mode 5. An engineering review was performed at that time but the cause could not be determined.

8.0 Additional Information

Unit 2 was in Mode 1 throughout this event and was unaffected, except for similar action required to address the circulating water screens blockage problems.

A copy of the modification package used to repair the steam driven

auxiliary feedwater pump was sent to Surry Power Station.

A summary of the steam driven auxiliary feedwater pump problem and the corrective actions taken was entered on Nuclear Network.

ATTACHMENT # 1 TO ANO # 8802080179 PAGE: 1 of 1

10 CFR 50.73

Vepco VIRGINIA ELECTRIC AND POWER COMPANY
NORTH ANNA POWER STATION
P. O. BOX 402
MINERAL, VIRGINIA 23117

February 3, 1988

U. S. Nuclear Regulatory Commission Serial No. N-88-002
Attention: Document Control Desk NO/DEQ: nih
Washington, D.C. 20555 Docket No. 50-338

License No. NPF-4

Dear Sirs:

The Virginia Electric and Power Company hereby submits the following Licensee Event Report applicable to North Anna Unit 1.

Report No. LER 88-002-00

This report has been reviewed by the Station Nuclear Safety and Operating Committee and will be forwarded to Safety Evaluation and Control for their review.

Very Truly Yours,
/s/ E. Wayne Harrell
E. Wayne Harrell
Station Manager

Enclosure
cc: U. S. Nuclear Regulatory Commission
101 Marietta Street, N. W.
Suite 2900
Atlanta, Georgia 30323

Mr. J. L. Caldwell
NRC Senior Resident Inspector

North Anna Power Station

*** END OF DOCUMENT ***